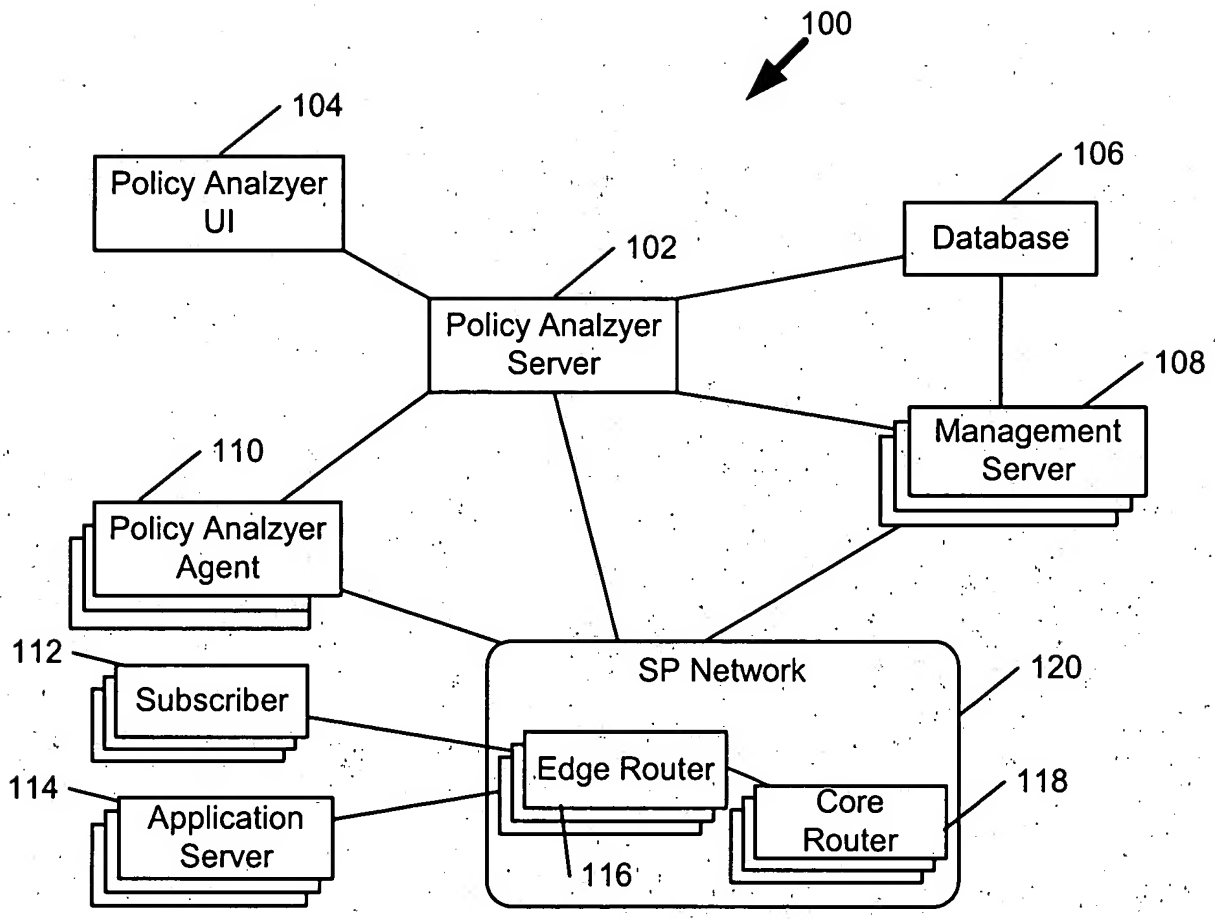
100
104
Policy Analzyer UI
106
Database
102
Policy Analzyer Server
108
Management Server
110
Policy Analzyer Agent
112
Subscriber
114
Application Server
SP Network
120
Edge Router
118
Core Router
116

FIG. 1

| Policy Rules | Description |
|---|---|
| PR1 | Rate Limit 64kbps ftp traffic.<br>Precedence 30 |
| PR2 | Forward Video teleconference.<br>Precedence 10 |

**Fig. 2**

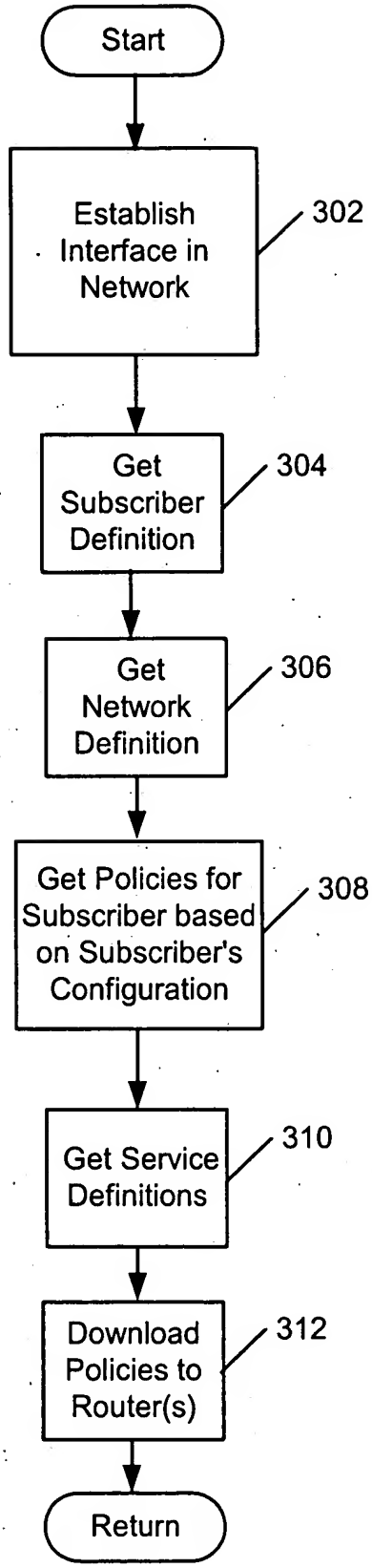
Start
Establish Interface in Network
302
Get Subscriber Definition
304
Get Network Definition
306
Get Policies for Subscriber based on Subscriber's Configuration
308
Get Service Definitions
310
Download Policies to Router(s)
312
Return

Fig. 3

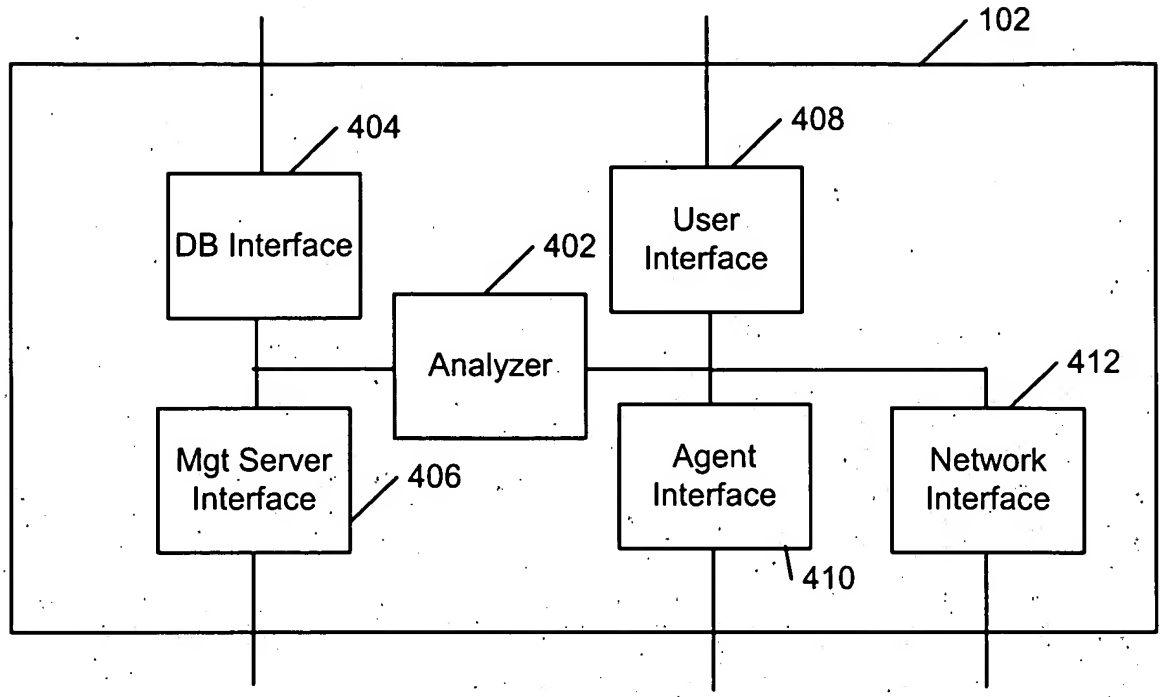
102
404
DB Interface
408
User Interface
402
Analyzer
412
Mgt Server Interface
406
Agent Interface
410
Network Interface

**Fig. 4**

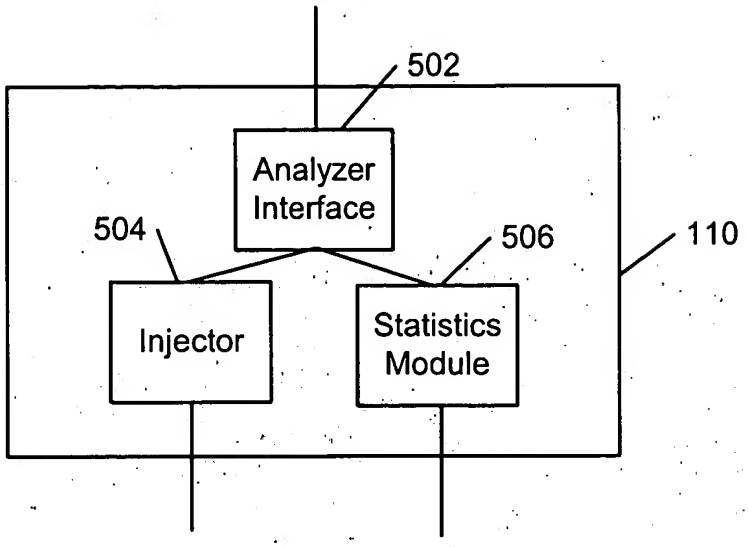
502
Analyzer Interface
504
506
110
Injector
Statistics Module

Fig. 5

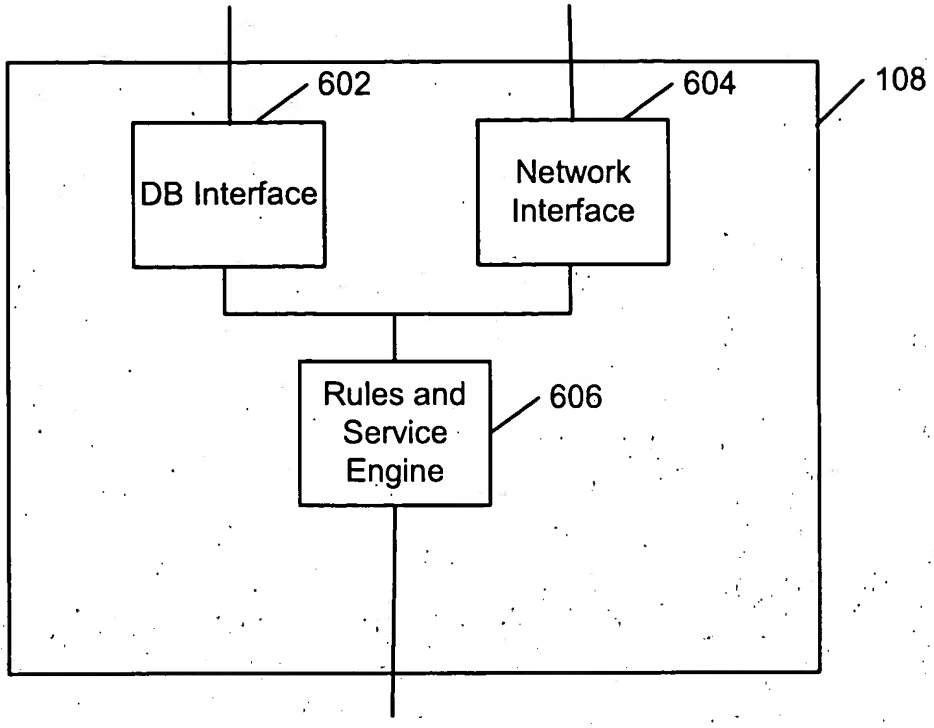
602
604
108
DB Interface
Network Interface
Rules and Service Engine
606

Fig. 6

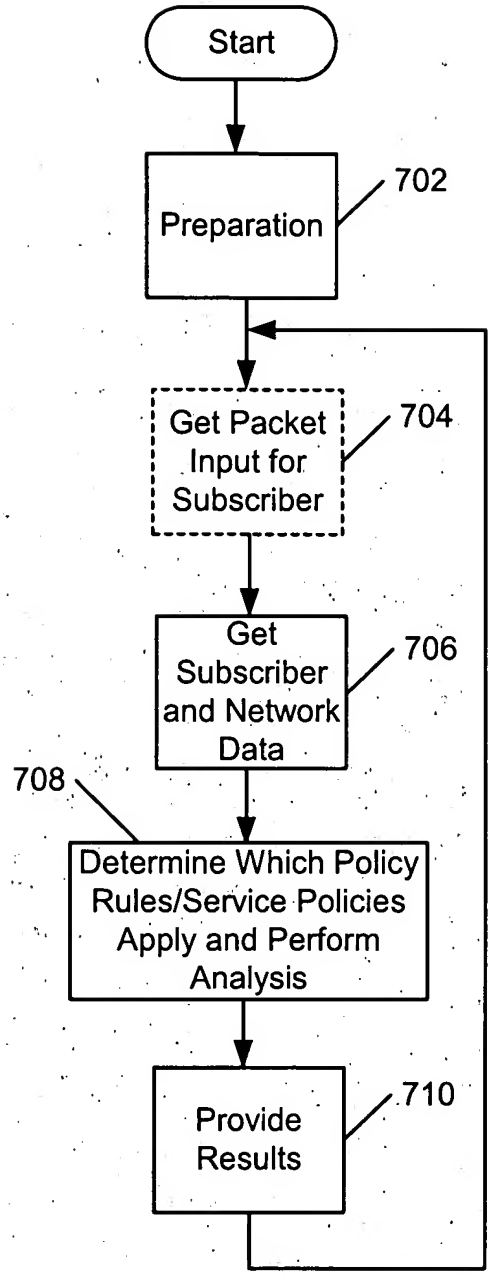
Start
Preparation
702
Get Packet Input for Subscriber
704
Get Subscriber and Network Data
706
708
Determine Which Policy Rules/Service Policies Apply and Perform Analysis
Provide Results
710

**Fig. 7**

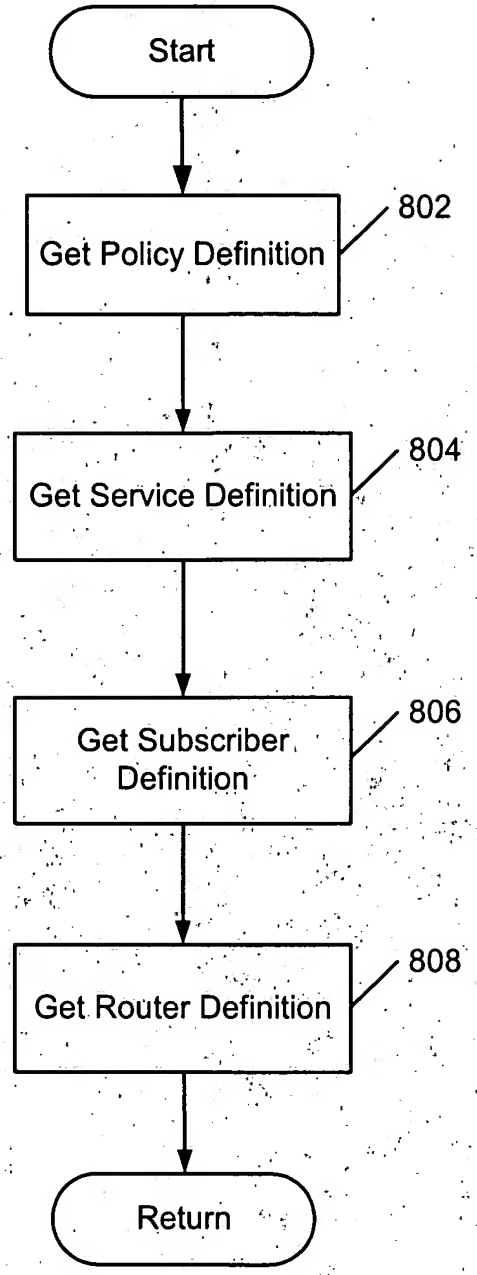
Start
Get Policy Definition
802
Get Service Definition
804
Get Subscriber Definition
806
Get Router Definition
808
Return

Fig. 8

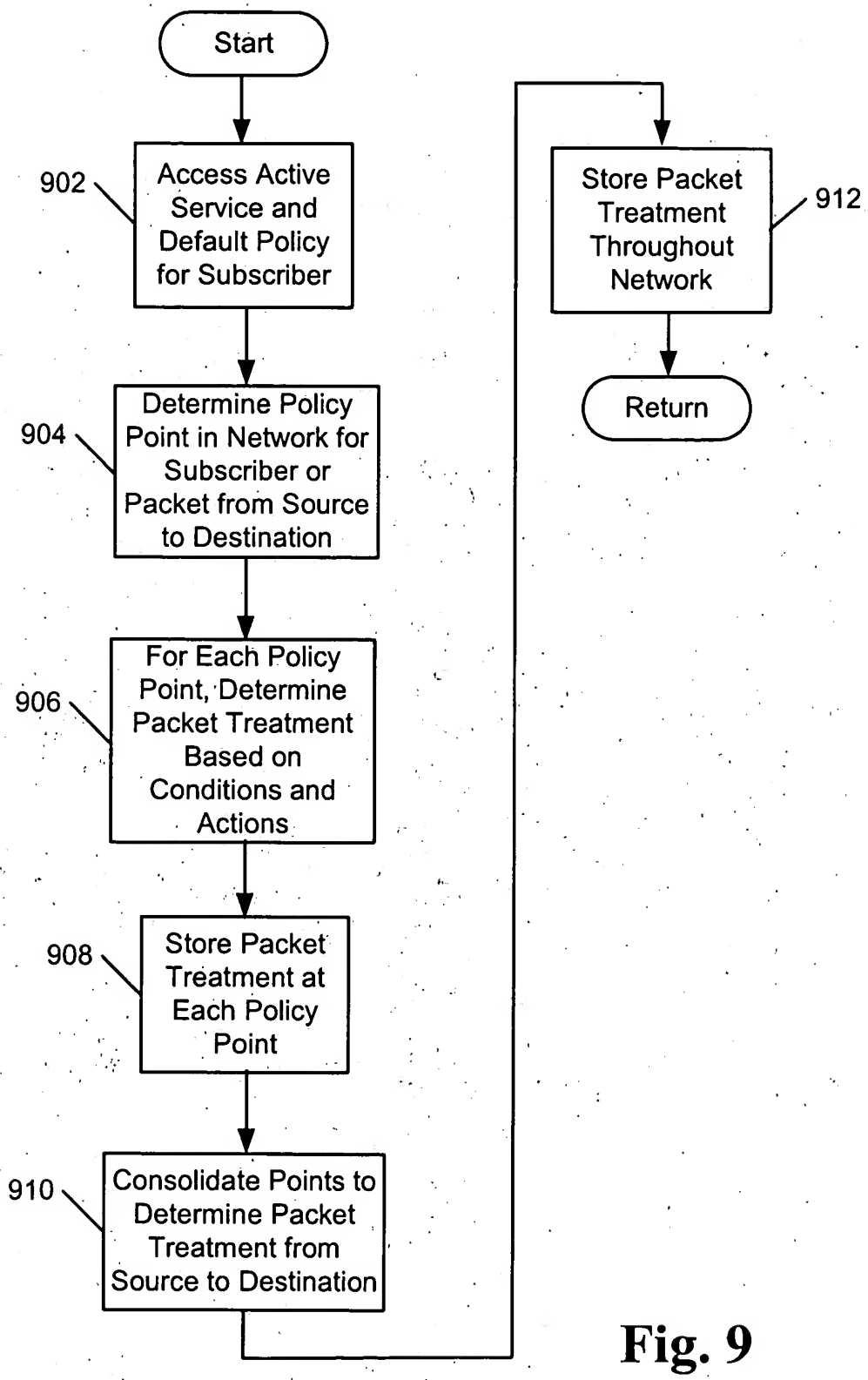
Start
902
Access Active Service and Default Policy for Subscriber
904
Determine Policy Point in Network for Subscriber or Packet from Source to Destination
906
For Each Policy Point, Determine Packet Treatment Based on Conditions and Actions
908
Store Packet Treatment at Each Policy Point
910
Consolidate Points to Determine Packet Treatment from Source to Destination
912
Store Packet Treatment Throughout Network
Return

Fig. 9

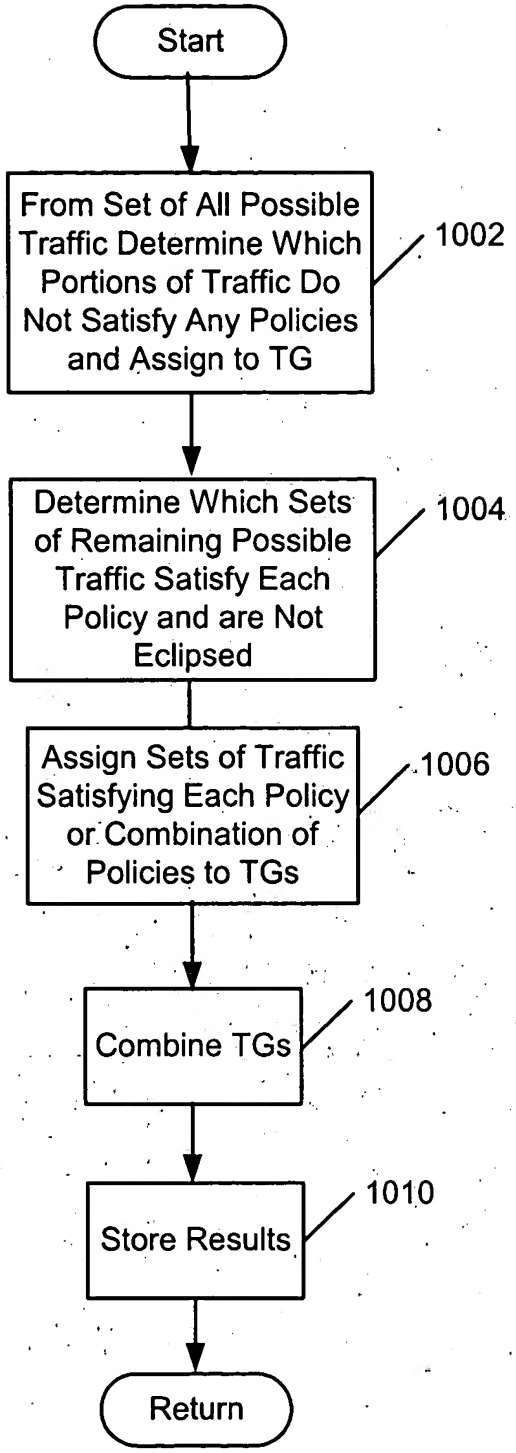
Start
From Set of All Possible Traffic Determine Which Portions of Traffic Do Not Satisfy Any Policies and Assign to TG
1002
Determine Which Sets of Remaining Possible Traffic Satisfy Each Policy and are Not Eclipsed
1004
Assign Sets of Traffic Satisfying Each Policy or Combination of Policies to TGs
1006
Combine TGs
1008
Store Results
1010
Return

Fig. 10

| Policy Rules | Description |
|---|---|
| PR1 | Rate Limit at 64 kbps FTP traffic. Precedence 30 |
| PR2 | Forward web traffic. Precedence 20 |
| PR3 | Forward ISP content server traffic. Precedence 10 |
| PR4 | Filter any traffic. Precedence 100 |

Fig. 11

| Traffic Group | Description | Policy Rules with matching condition |
|---|---|---|
| TG1 | FTP traffic not 10.10.10.0/24 | [PR1] |
| TG2 | www traffic not 10.10.10.0/24 | [PR2] |
| TG3 | 10.10.10.0/24 traffic (including FTP and www) | [PR3] |
| TG4 | Not FTP or WWW and not 10.10.10.0/24 | [PR4] |

Fig. 12

| Policy Rules | Description |
|---|---|
| PR1 | match 10.10.10.0/24 traffic |
| PR2 | match 20.20.20.0/24 traffic |
| PR3 | match 10.10.0.0/16 traffic |

Fig. 13

| Address Range | Policy Rules with Matching Conditions |
|---|---|
| 0.0.0.0 - 10.9.255.255 | [] |
| 10.10.0.0 - 10.10.9.255 | [PR3] |
| 10.10.10.0 - 10.10.10.255 | [PR1, PR3] |
| 10.10.11.0 - 10.10.255.255 | [PR3] |
| 10.11.0.0 - 20.20.19.255 | [] |
| 20.20.20.0 - 20.20.20.255 | [PR2] |
| 20.20.21.0 - 255.255.255.255 | [] |

Fig. 14

| TG | Address Range | Policy Rules with Matching Conditions |
|---|---|---|
| 1 | 0.0.0.0 - 10.9.255.255 | [] |
| 2 | 10.10.0.0 - 10.10.9.255 | [PR3] |
| 3 | 10.10.10.0 - 10.10.10.255 | [PR1, PR3] |
| 2 | 10.10.11.0 - 10.10.255.255 | [PR3] |
| 1 | 10.11.0.0 - 20.20.19.255 | [] |
| 4 | 20.20.20.0 - 20.20.20.255 | [PR2] |
| 1 | 20.20.21.0 - 255.255.255.255 | [] |

Fig. 15

| TG | Address Range | Policy Rules with Matching Conditions |
|---|---|---|
| 1 | 0.0.0.0 - 10.9.255.255<br>10.11.0.0 - 20.20.19.255<br>20.20.21.0 - 255.255.255.255 | [] |
| 2 | 10.10.0.0 - 10.10.9.255<br>10.10.11.0 - 10.10.255 255 | [PR3] |
| 3 | 10.10.10.0 - 10.10.10.255 | [PR1, PR3] |
| 4 | 20.20.20.0 - 20.20.20.255 | [PR2] |

Fig. 16

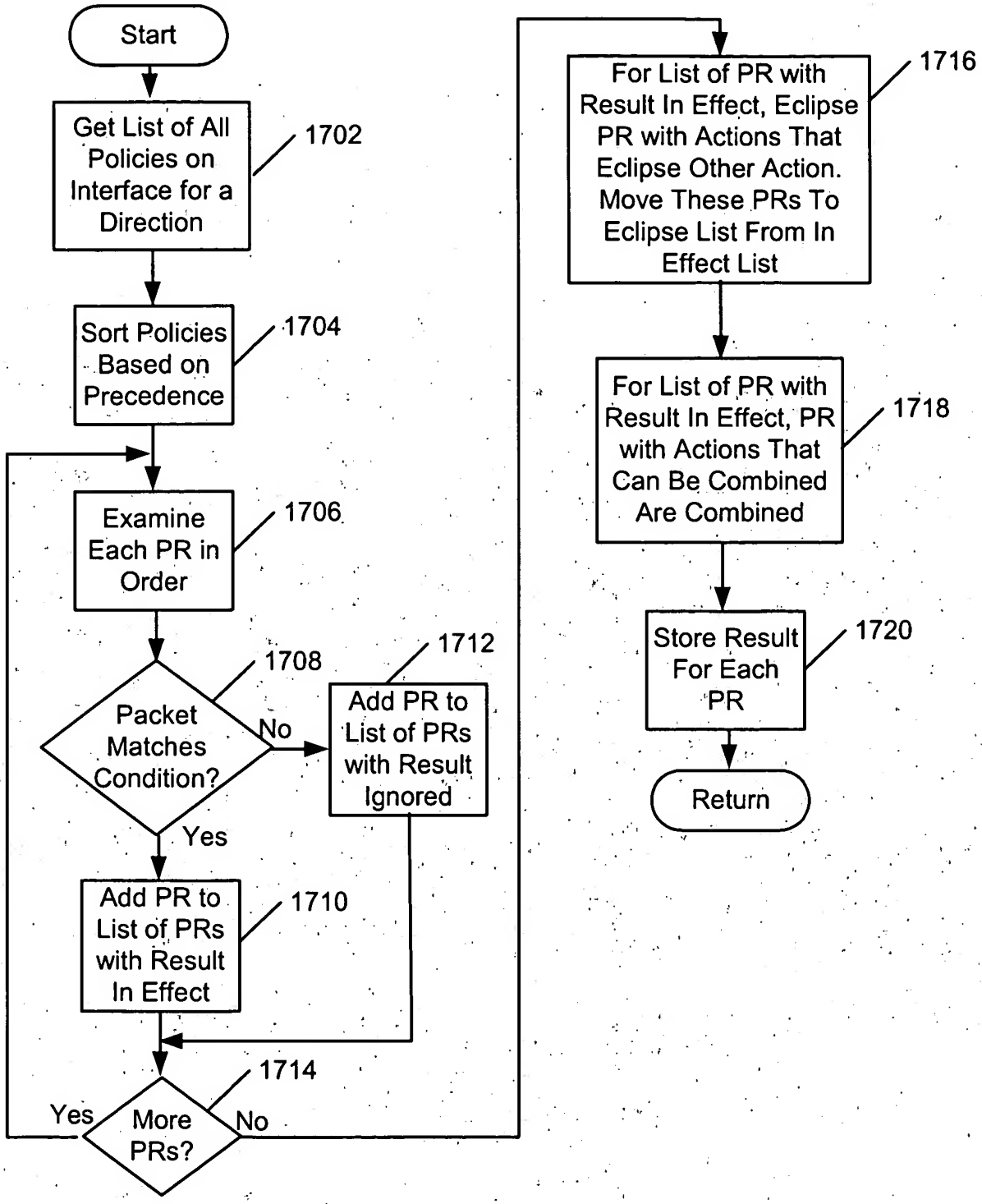
Start
Get List of All Policies on Interface for a Direction
1702
Sort Policies Based on Precedence
1704
Examine Each PR in Order
1706
Packet Matches Condition?
1708
No
Yes
Add PR to List of PRs with Result Ignored
1712
Add PR to List of PRs with Result In Effect
1710
More PRs?
1714
Yes
No
For List of PR with Result In Effect, Eclipse PR with Actions That Eclipse Other Action. Move These PRs To Eclipse List From In Effect List
1716
For List of PR with Result In Effect, PR with Actions That Can Be Combined Are Combined
1718
Store Result For Each PR
1720
Return

Fig. 17

| Service Session | PR | PRECEDENCE | SOURCE | DESTINATION | ACTION | Analysis | |
|---|---|---|---|---|---|---|---|
| | | | | | | A1 | A2 |
| PPP | To_cp1 | 300 | any | ?cp1 | NextHop | Eclipsed | Ignored |
| PPP | To_cp2 | 300 | any | ?cp2 | NextHop | Ignored | Eclipsed |
| PPP | To_SAE | 500 | any | ?SAE | Forward | Ignored | Ignored |
| | | | | | | | |
| Be512 | Internet | 400 | any | not ?cp1 and not ?cp2 | Forward | Ignored | Ignored |
| | | | | | | | |
| CP1 | Cp1 | 200 | any | ?cp1 | RateLimitX | In Effect | Ignored |
| | | | | | | | |
| CP2 | Cp2 | 200 | any | ?cp2 | RateLimitY | Ignored | In Effect |
| | | | | | | | |

**Fig. 18**

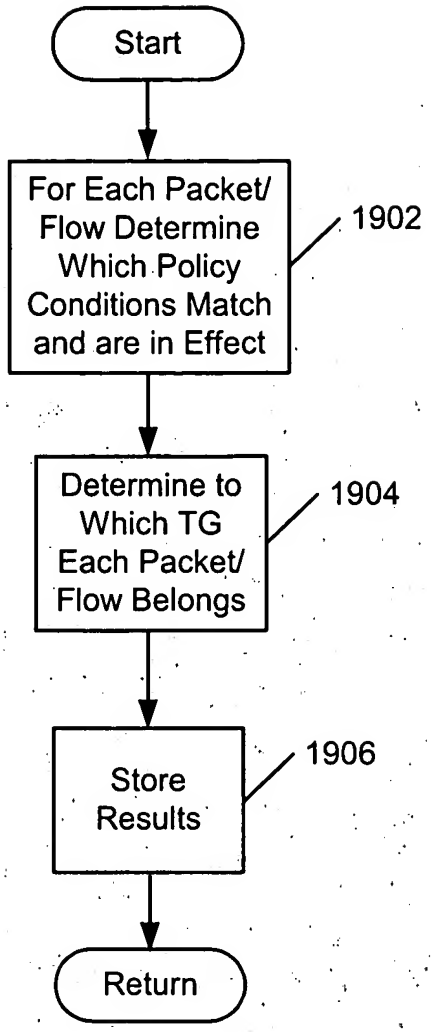
Start
For Each Packet/ Flow Determine Which Policy Conditions Match and are in Effect
1902
Determine to Which TG Each Packet/ Flow Belongs
1904
Store Results
1906
Return

Fig. 19

| Packet/Flow | Important/relevant characteristics of packet |
|---|---|
| A1 | FTP traffic from 1.1.1.1 |
| A2 | www traffic from 1.1.1.1 |
| A3 | telnet traffic from 1.1.1.1<br>source port: telnet (23) |
| A4 | SMTP traffic from 1.1.1.1 |
| A5 | A video packet from the ISP content server at 10.10.10.2 (server subnet is 10.10.10.0./24) |

Fig. 20

| Packet/Flow | Point Analysis at Router X |
|---|---|
| A1 | PR1 and PR4 matched. PR1 is in effect. PR4 is eclipsed due to precedence. |
| A2 | PR2 and PR4. PR2 is in effect. PR4 is eclipsed due to precedence. |
| A3 | PR4 is in effect |
| A4 | PR4 is in effect |
| A5 | PR3 and PR4 matched. PR3 is in effect due to precedence. |

Fig. 21

| Packet/Flow | Traffic Group | Policy Rules In Effect |
|---|---|---|
| A1 | Belongs to TG1 | PR1 |
| A2 | Belongs to TG2 | PR2, PR4 |
| A3 | Belongs to TG4 | PR4 |
| A4 | Belongs to TG4 | PR4 |
| A5 | Belongs to TG3 | PR3 |

Fig. 22

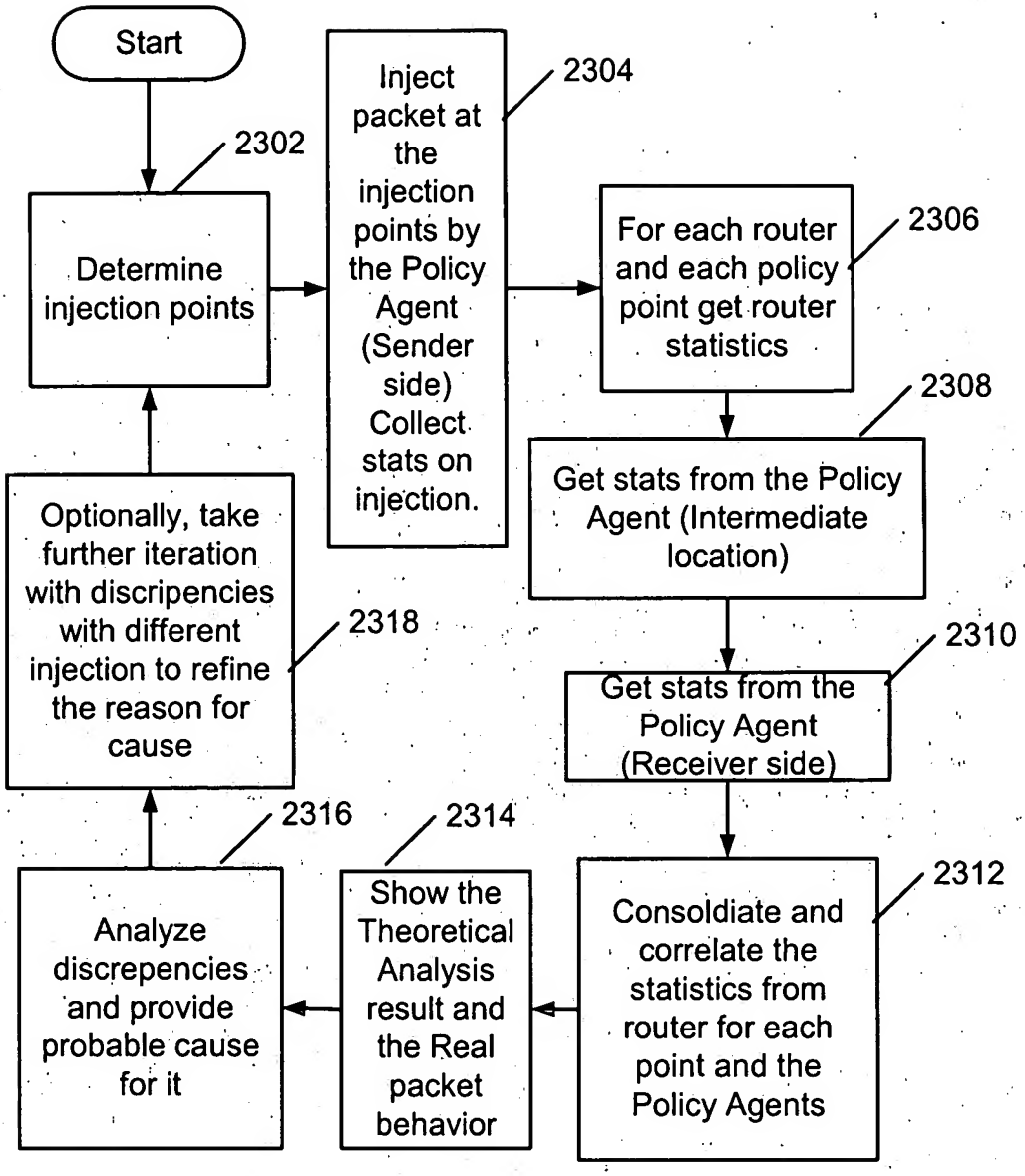
Start
2302
Determine injection points
Inject packet at the injection points by the Policy Agent (Sender side) Collect stats on injection.
2304
For each router and each policy point get router statistics
2306
Get stats from the Policy Agent (Intermediate location)
2308
Get stats from the Policy Agent (Receiver side)
2310
Consoldiate and correlate the statistics from router for each point and the Policy Agents
2312
Show the Theoretical Analysis result and the Real packet behavior
2314
Analyze discrepencies and provide probable cause for it
2316
Optionally, take further iteration with discripencies with different injection to refine the reason for cause
2318

Fig. 23